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Sulfur, Carbon, and Nitrogen Isotopic Composition of Fish from the Mackenzie River Delta Region and other Arctic Drainages

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March 1989

Canadian Data Report of Fisheries and Aquatic Sciences No. 728

Fisheries and Oceans Pêches et Océans

Canada

89-03042/

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Canadian Data Report of
Fisheries and Aquatic Sciences 728

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by

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This is the 29th Data Report
from the Central and Arctic Region, Winnipeg

PREFACE

This study was funded by the Northern Oil and Gas Action Program (NOGAP), Project 3.3, through the Department of Fisheries and Oceans, Central and Arctic Region.

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Cat. no. Fs 97-13/728E ISSN 0706-6465

Correct citation for this publication is:

Hesslein, R.H., D.E. Fox, and M.J.Capel. 1989. Sulfur, carbon, and nitrogen isotopic composition of fish from the Mackenzie River Delta Region and other Arctic drainages. Can. Data Rep. Fish. Aquat. Sci. 728:iv + 11 p.

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ABSTRACT

Hesslein, R.H., D.E. Fox, and M.J. Capel. 1989. Sulfur, carbon, and nitrogen isotopic composition of fish from the Mackenzie River Delta Region and other Arctic drainages. Can. Data Rep. Fish. Aquat. Sci. 728: iv + 11 p.

Muscle tissue from 242 fish of nine species from the lower Mackenzie River and other arctic drainages were analyzed for isotopic composition of sulfur, carbon, and nitrogen. The purpose of the study was to use the stable isotope values to help interpret the migration patterns and food web status of the fish. Sulfur values ranged from -20 to +18 per mil versus Canyon Diabolo, carbon from -35 to -21 per mil versus PDB, and nitrogen from +6 to +15 per mil versus air. Methods for the isotopic analyses were developed through modification of published methods for convenience of sample handling. The methods are given in detail. The samples are cross-listed with identification numbers of other investigators from whom the fish tissues were received.

Key words: Mackenzie River; Tuktoyaktuk Peninsula; Yukon north slope; sulfur isotopes; carbon isotopes; nitrogen isotopes; mass spectroscopy; fish, migrations; food webs.

RÉSUMÉ

Hesslein, R.H., D.E. Fox, and M.J. Capel. 1989. Sulfur, carbon, and nitrogen isotopic composition of fish from the Mackenzie River Delta Region and other Arctic drainages. Can. Data Rep. Fish. Aquat. Sci. 728: iv + 11 p.

Des tissus musculaires de 242 poissons appartenant à neuf espèces différentes provenant du cours inférieur du Mackenzie et d'autres bassins hydrographiques de l'Arctique ont été analysés dans le but de déterminer leur composition isotopique en soufre, en carbone, et en azote. Le but de l'étude était d'utiliser les valeurs isotopiques stable pour faciliter l'interprétation des données sur la migration des poissons en cause et leur position dans le réseau trophique. Les valeurs obtenues ont été les suivantes: -20 à +18 p. 1000 par rapport à Canyon Diabolo dans le cas du soufre; -35 à -21 p. 1000 par rapport à PDB dans le cas du carbone et +6 à +15 p. 1000 par rapport à l'air dans le cas de l'azote. Pour l'analyse isotopique, nous avons utilisé des méthodes publiées que nous avons modifiées pour faciliter le traitement des échantillons. Le détail des méthodes est fourni. Les échantillons sont accompagnés d'une liste de numéros permettant d'identifier les autres chercheurs ayant fourni les tissus.

Mots-clés : fleuve Mackenzie; péninsule de Tuktoyaktuk; versant nord du Yukon; isotopes du soufre; isotopes du carbone; isotopes de l'azote;spectrométrie de masse; poisson; migrations; réseaux trophiques.

INTRODUCTION

As part of the Northern Oil and Gas Action Program (NOGAP) we initiated a study to determine the utility of the stable isotopes of sulfur, carbon, and nitrogen for describing the food web and migration patterns of fish in the lower Mackenzie River, N.W.T. and other arctic drainages. It was the intent of this project to make use of the sample collection opportunities provided by other NOGAP funded projects. These were primarily the study of genetic groupings of fish being carried out by Dr. J. D. Reist's group (Reist 1987) which covered a large number of arctic drainages, and the limnological studies of Dr. R. E. Hecky's group (Fee et al. 1988) in the lakes of the Mackenzie Delta and Tuktoyaktuk Peninsula. As a consequence of this strategy, considerable additional information is available on both the samples analyzed and the sites from which they were taken. Where applicable, we have listed the identification numbers assigned by these other researchers with our data. A set of arctic char samples was made available from an old collection used for the Ph.D. thesis of J. D. Dutil (Dutil 1982). These samples came from the Nauyuk River drainage, N.W.T. Some had been starved in tanks as part of a metabolic experiment.

In our initial efforts, we concentrated on determining the sulfur isotope composition of fish as a tracer of site fidelity and stock groupings. This involved two stages of study: first, to determine the range of the isotope signal over a wide range of habitats and the variance within sub-populations which shared feeding habits and migration patterns; and second, to determine which stable isotope signals came from each of the variety of habitats available to the migrating fish. Carbon and nitrogen isotopes were analyzed because they provide indications about the source of food and the level in the food chain occupied by the organisms. The ranges of carbon isotope values in various aquatic systems and the fractionation of nitrogen isotopes in food chain transfers have recently been reviewed (Peterson and Fry 1987). For the study of these isotopes, we concentrated our efforts on larger numbers of species from specific habitats. Non-fish species and other ecosystem components are part of that study, but will be reported elsewhere.

Because of the integrated nature of the sub-projects of NOGAP project B.3 we felt it was important to make the stable isotope data available in concise report form. Sample sets of the sort that were available to us are expensive and time consuming to collect. The stable isotope data set from these samples is thus quite unique and although it will be interpreted by our group in other publications, it should be available to other researchers.

METHODS

ISOTOPIC ANALYSES OF SULFUR

Sampling methods

Sampling methods for fish varied between sites and studies depending on the most efficient catch method for each situation. In general, whole fish were frozen shortly after being caught and shipped to the Freshwater Institute where they were held at -40°C. The fish were partially thawed for dissection and a piece (10 g) of muscle tissue was taken from adjacent to the dorsal fin. For very small fish this was not possible, and the whole fish was used. The sample tissues were placed in marked plastic liquid scintillation vials and stored in the freezer.

Sample size

The sample weight for sulfur isotope analysis is chosen on the basis of the expected mass of sulfur contained in it. Typically, without using the cold finger option on the mass spectrometer, about two cubic centimeters (STP) of sulfur dioxide are required for isotopic analysis. This is ~90 uMole of sulfur or ~3 mg S. Since fresh fish tissue has ~1% sulfur per dry weight and ~80% water, this translates to ~1 g wet weight. Usually, ~3 g are used so that the analysis can be replicated without repeating the extensive digestion procedure.

Tissue digestion

The tissue sample is covered with cold concentrated nitric acid (HNO_3) in a beaker covered with a watchglass, left overnight, and then heated gradually on a hotplate. The reaction can become quite vigorous so heat must be applied with caution. More heat can be applied as the reaction subsides. In the early stages of the digestion the sample should not be allowed to dry or carbonize. After some time, usually 2-3 days, the liquid will clear and fuming will cease. At this time 0.5 g sodium nitrate ($NaNO_3$) are added. This acts as a flux in the later muffle furnace stage. The watchglass is then removed and the solution allowed to evaporate to dryness. If the solution begins to cloud or char, more nitric acid is added and evaporation is continued. A properly digested sample dries to a white powder. During the stages with the watchglass, the samples need to be checked 2-3 times per day. Hourly checks are required when evaporating. About 150 mL of concentrated nitric acid are typically required to digest 3 g of tissue.

The beaker with the residual white powder is placed in a furnace for 14 h (overnight) at 380°C. The sample is then brought to 60 mL in deionized water and acidified with 3N nitric acid (0.5-1.0 mL are normally sufficient). In some cases the sample will not entirely dissolve. It is then filtered (Whatman GFC®) and the filtrate retained.

Barium sulfate precipitation and thermal decomposition

Two milliliters of 1N barium chloride ($BaCl_2$) are added and the sample brought to just below boiling on a hotplate for one hour. The temperature is then lowered (80°C) and the sample left to digest overnight to produce an easily filterable precipitate. The barium sulfate ($BaSO_4$) is then filtered (Whatman 42®, ashless) and placed in a covered platinum crucible in a furnace at 800°C for two hours. After cooling, 20 mg of $BaSO_4$ is weighed out into a Vycor® ignition tube (15 cm long, 6 mm I.D., 9 mm O.D.)and mixed in a 3:1 ratio (60 mg)

with dry sodium hexametaphosphate ($(NaPO_3)_6$). The tube is plugged with quartz wool 1 cm above the sample and 3 cm of chopped copper wire added on top of the plug. The $BaSO_4$ is then decomposed to sulfur dioxide (SO_2) at 800°C, as in the method of Halas and Wolacewicz (1981), for introduction to the mass spectrometer.

ISOTOPIC ANALYSES OF CARBON AND NITROGEN

Sample size

Carbon and nitrogen for isotopic analyses are produced simultaneously. The sample weight required is determined by the mass of the less abundant nitrogen. One cubic centimeter (STP) of nitrogen is usually produced for mass spectrometry. This is ~2.5 mg N, and since fish are ~10% nitrogen on a dry weight basis, this translates to 15 mg dry fish or 60 mg fresh fish. This amount yields a large excess of carbon dioxide (CO_2) for carbon analyses.

Tissue decomposition

The sample is freeze dried and ground or cut into small pieces. It is then placed in a 25 cm long (7 mm I.D., 9 mm O.D.) Pyrex® tube (Vycor® can withstand higher temperature but is more expensive) with 1 g of chopped copper wire, 1 g chopped copper oxide wire, and a small (2x2 mm) piece of pure silver foil. The volume (length) of the tubing is determined by the total amount of CO_2+N_2 gas expected. The tube is then evacuated overnight to pressure below $5x10^{-6}$ atm and flame sealed under vacuum. The sealed tubes are placed in protective steel tubes (one occasionally explodes) in a cold furnace and heated at 600°C (as high as 800°C with Vycor®) for 4 h. The furnace is turned off and allowed to cool overnight while still closed. Rapid cooling will result in tube breakage.The above procedure is a modified Dumas method (Stump and Frazer 1973). No difference could be measured in isotopic composition of CO_2 and N_2 produced at 600°C in Pyrex® versus 800°C in Vycor®, but below 600°C the decomposition is not reproducible.

Extraction and purification of gases

The carbon dioxide and nitrogen gases are cryogenically purified and separated prior to introduction to the mass spectrometer. The sample tube is scored and placed in a piece of heavy walled flexible vacuum tubing attached to the vacuum rack. After the rack is pumped clean and closed, the tube is broken allowing the gases into a glass bead filled trap at -65°C. This removes traces of water. The sample is then slowly leaked through a trap at -196°C (liquid N_2) to trap CO_2 and to a removable trap vessel filled with 5A molecular sieve at -196°C to trap N_2. The CO_2 trap is warmed and CO_2 transferred to a removable vessel at -196°C. The removable vessels are stored for analyses by the mass spectrometer. The CO_2 is introduced to the mass spectrometer with the vessel held at -65°C to further ensure a dry sample. The vessel containing the N_2 is heated to 200°C to ensure unfractionated release of N_2 from the molecular sieve. After analyzing the sample at this temperature, the molecular sieve is evacuated to prepare it for the next use. Before the initial use, the molecular sieve must be cleaned by 16 h evacuation at 375°C.

MASS SPECTROMETRY

All isotopic analyses were performed on a VG Micromass® 602E isotope ratio mass spectrometer. The unit was equipped with a fully heated inlet and capillary section held at 110°C. Machine standardization for sulfur was against a tank of SO_2. $BaSO_4$ from Hudson Bay water prepared in bulk was used as a system standard with each batch of samples. This standard has been checked against Pacific seawater sulfate assigned a value of 21.0 o/oo vs Canyon Diabolo (Rees et al. 1978). The machine standard for nitrogen was a tank of gas standardized against purified air and a peptone standard from Dr. Nevin, Harvard University. Carbon dioxide as a machine standard was produced each day by decomposing $CaCO_3$ at 800°C. The $CaCO_3$ has been calibrated against SFU-SIS-801 (Simon Fraser University, Radiocarbon Dating Laboratory) with an assigned value of -20.20 o/oo vs PDB. Overall precision (2 SD) over several years of operation is estimated at 0.3 o/oo for sulfur, 0.1 o/oo for carbon, and 0.5 o/oo for nitrogen.

RESULTS

The locations at which the fish were caught (Table 1) are given with latitude, longitude, and the abbreviations of the locations used in Table 3. Some locations have been separated depending whether fish were caught swimming upstream or downstream. Further descriptions of the locations can be found in Reist (1987). The names of the nine fish species analyzed and the abbreviations used in Table 3 are found in Table 2. The predominant species analyzed was the broad whitefish which is the primary species being studied by Reist. The results of the isotopic analyses are listed (Table 3) alphabetically by location and species abbreviation. Weight, length, sex, and catch date are from Reist (1987) or Dutil (1982). The letters ND are used to signify no data available and NA is used where no analyses were done.

ACKNOWLEDGMENTS

We would like to thank Jim Reist and his crews which caught fish in the field and which dissected fish in the lab. Bob Hecky's field crews also provided samples. Stan Ambrose and Nevins' group at Harvard gave useful advice for high vacuum methods. Kim Hallard assisted with some of the isotopic analyses.

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Table 1. Locations of fish catches.

Abbreviation used	Latitude North	Longitude West	Description and drainage
ANDERSON R.	69 19	128 33	Anderson River
ARCTIC RED R. CO	67 27	133 46	Arctic Red River at confluence with Mackenzie R.
ARCTIC RED R. UP	67 11	133 32	Arctic Red River upstream of confluence
BIG LAKE	68 21	133 47	East Channel, McKenzie River Delta
COX LAKE	67 53	116 38	Richardson River
HORSESHOE BEND	68 14	134 15	Mackenzie River
KOBUK R.	66 58	160 26	Kobuk River, Alaska
KUK CRK DS	69 36	132 54	Kukjuktuk Creek, downstream run, Tuktoyaktuk Penninsula
KUK CRK US	69 36	132 54	Kukjuktuk Creek, upstream run, Tuktoyaktuk Penninsula
LAKE 18	69 31	132 29	Kukjuktuk Creek, Tuktoyaktuk Penninsula
MACKENZIE R. E	68 19	133 41	Mackenzie River, East Channel
MACKENZIE R. U	67 11	128 57	Mackenzie River, upstream location
NAUYUK R. D	68 22	107 40	Nauyuk River downstream run, Kent Penninsula
NAUYUK R. U	68 22	107 40	Nauyuk River, upstream run, Kent Penninsula
PEEL R.	67 20	134 52	Peel River, Mackenzie River drainage
SKIDOO LAKE	68 19	133 51	Mackenzie River Delta, East Channel
SOUTH LAKE	68 18	133 51	Mackenzie River Delta, East Channel
STARVATION	68 22	107 40	Nauyuk River, held in tanks and starved
TRAVAILLANT LAKE	67 44	131 50	Travaillant River, Mackenzie River drainage
WILLOW CREEK D	68 22	107 40	Nauyuk River drainage, downstream run
WILLOW CREEK U	68 22	107 40	Nauyuk River drainage, upstream run
YUKON R.	65 40	150 00	Yukon River, Alaska

Table 2. Species names used in Table 3 with common and scientific names.

Abbreviation	Common Name	Scientific Name
A.CHARR	Arctic Char complex	*Salvelinus alpinus* (Linnaeus)
C.CLUPE	Lake Whitefish complex	*Coregonus clupeaformis* (Mitchell)
C.NASUS	Broad Whitefish	*Coregonus nasus* (Pallas)
C.W.SUCKER	White Sucker	*Catostomus commersoni* (Lacepede)
INCONNU	Inconnu	*Stenodus leucichthys* (Guldenstadt)
L.CISCO	Least Cisco complex	*Coregonus sardinella* (Valenciennes)
L.TROUT	Lake Trout	*Salvelinus namaycush* (Waldbaum)
N.PIKE	Northern Pike	*Esox lucius* (Linneaus)
N.S.BACK	Nine-spine Stickleback	*Pungitius pungitius* (Linneaus)
YOY PIKE	Northern Pike (>1 year)	*Esox lucius* (Linnaeus)

Table 3. Isotope data for NOGAP fish.

Location	Species	Weight (grams)	Length (cm)	Sex	Tissue	Date dd/mm/yy	S-34/32 (o/oo)	C-13/12 (o/oo)	N-15/14 (o/oo)	Lab ID Number	Reist ID Number
ANDERSON R.	C.NASUS	2187.0	ND	M	Musc.	30/09/84	-6.34	-27.84	8.65	3137.0	0016140
ANDERSON R.	C.NASUS	3670.0	ND	F	Musc.	30/09/84	-8.58	-29.00	9.37	3139.0	0016138
ANDERSON R.	C.NASUS	2660.0	ND	M	Musc.	30/09/84	-8.30	NA	NA	3135.0	0016142
ANDERSON R.	C.NASUS	2511.0	ND	F	Musc.	30/09/84	4.33	-28.51	9.90	3138.0	0016139
ANDERSON R.	C.NASUS	2858.0	ND	F	Musc.	30/09/84	0.71	NA	NA	3134.0	0016145
ANDERSON R.	C.NASUS	1699.0	ND	F	Musc.	30/09/84	4.28	NA	NA	3136.0	0016141
ARCTIC RED R. CO	C.NASUS	1902.0	48.7	F	Musc.	30/09/84	0.06	NA	NA	3039.0	0016432
ARCTIC RED R. CO	C.NASUS	1777.0	ND	F	Musc.	30/09/84	-2.04	NA	NA	3038.0	0016433
ARCTIC RED R. CO	C.NASUS	2486.0	52.0	M	Musc.	30/09/84	-4.04	-26.89	6.70	3041.0	0016430
ARCTIC RED R. CO	C.NASUS	1675.0	47.5	F	Musc.	30/09/84	-3.99	NA	NA	3040.0	0016431
ARCTIC RED R. CO	C.NASUS	2241.0	51.6	M	Musc.	30/09/84	-15.85	-32.81	8.95	3036.0	0016460
ARCTIC RED R. CO	C.NASUS	1931.0	48.9	M	Musc.	30/09/84	1.71	-26.22	6.65	3037.0	0016453
ARCTIC RED R. UP	C.NASUS	1463.0	47.5	M	Musc.	30/09/84	-7.00	NA	NA	3114.0	0016155
ARCTIC RED R. UP	C.NASUS	1557.0	46.1	M	Musc.	30/09/84	-13.64	NA	NA	3115.0	0016111
ARCTIC RED R. UP	C.NASUS	1478.0	46.6	M	Musc.	30/09/84	-6.98	NA	NA	3116.0	0016110
ARCTIC RED R. UP	C.NASUS	1897.0	50.2	M	Musc.	30/09/84	-6.68	-25.21	8.07	3117.0	0016013
ARCTIC RED R. UP	C.NASUS	2344.0	53.7	F	Musc.	30/09/84	-11.22	-28.56	8.57	3113.0	0016156
ARCTIC RED R. UP	C.NASUS	1981.0	50.1	M	Musc.	30/09/84	-3.83	-27.68	6.68	3118.0	0016012
BIG LAKE	C.CLUPE	283.0	27.4	F	Musc.	20/07/85	-0.72	-27.16	6.75	3424.0	0017420
BIG LAKE	C.CLUPE	497.0	ND	M	Musc.	20/07/85	1.24	-25.31	6.56	3421.0	0017417
BIG LAKE	C.CLUPE	357.0	29.0	F	Musc.	20/07/85	0.01	-26.50	9.34	3422.0	0017418
BIG LAKE	C.CLUPE	701.0	36.4	M	Musc.	20/07/85	5.01	-27.34	6.54	3425.0	0017421
BIG LAKE	C.CLUPE	474.0	32.3	F	Musc.	20/07/85	2.20	-27.35	9.70	3423.0	0017419
BIG LAKE	C.NASUS	1898.0	48.0	M	Musc.	20/07/85	-4.97	-32.86	8.62	3419.0	0017486
BIG LAKE	INCONNU	1114.0	49.6	M	Musc.	20/07/85	4.72	-25.74	12.00	3415.0	0017479
BIG LAKE	INCONNU	688.0	41.5	M	Musc.	20/07/85	0.63	-25.13	11.88	3418.0	0017868
BIG LAKE	INCONNU	761.0	41.7	M	Musc.	20/07/85	1.90	-26.69	12.56	3413.0	0017564
BIG LAKE	INCONNU	2056.0	59.8	M	Musc.	20/07/85	-0.11	-28.83	11.18	3414.0	0017478
BIG LAKE	INCONNU	305.0	33.1	M	Musc.	20/07/85	0.48	-26.61	11.07	3416.0	0017480
BIG LAKE	INCONNU	9095.0	46.7	M	Musc.	20/07/85	-1.10	-26.84	10.47	3417.0	0017481
COX LAKE	C.CLUPE	1180.0	44.1	M	Musc.	30/11/84	12.88	-21.93	7.45	3016.0	0016510
COX LAKE	C.CLUPE	2701.0	57.7	M	Musc.	30/11/84	13.17	-21.17	7.73	3015.0	0016511
COX LAKE	C.CLUPE	1712.0	ND	F	Musc.	30/11/84	12.82	-22.55	8.09	3018.0	0016507
COX LAKE	C.CLUPE	1127.0	45.1	F	Musc.	30/11/84	12.74	-21.69	7.43	3017.0	0016508
COX LAKE	C.NASUS	2009.0	51.0	F	Musc.	30/11/84	11.28	-25.59	8.59	3019.0	0016429
COX LAKE	C.NASUS	2693.0	55.3	F	Musc.	30/11/84	13.11	-24.09	7.74	3020.0	0016428
HORSESHOE BEND	C.NASUS	2142.0	52.0	F	Musc.	31/08/84	-6.49	-25.58	5.17	3151.0	0016103
HORSESHOE BEND	C.NASUS	2016.0	49.2	M	Musc.	11/11/84	NA	-27.35	6.09	3291.0	0016128
HORSESHOE BEND	C.NASUS	2035.0	51.0	M	Musc.	31/08/84	-1.52	NA	NA	3010.0	0016639
HORSESHOE BEND	C.NASUS	1671.0	47.2	F	Musc.	30/09/84	-3.04	-26.39	6.90	3006.0	0016671
HORSESHOE BEND	C.NASUS	2008.0	49.8	M	Musc.	31/10/84	-1.12	NA	NA	3125.0	0016122
HORSESHOE BEND	C.NASUS	1761.0	48.5	M	Musc.	31/08/84	-19.33	NA	NA	3149.0	0016105
HORSESHOE BEND	C.NASUS	1596.0	46.6	M	Musc.	31/10/84	-1.28	NA	NA	3124.0	0016123
HORSESHOE BEND	C.NASUS	1941.0	48.8	F	Musc.	31/08/84	-1.41	-25.29	NA	3153.0	0016101
HORSESHOE BEND	C.NASUS	2429.0	53.8	M	Musc.	31/08/84	-1.90	-25.93	7.43	3013.0	0016636

Table 3. Cont'd.

Location	Species	Weight (grams)	Length (cm)	Sex	Tissue	Date dd/mm/yy	S-34/32 (o/oo)	C-13/12 (o/oo)	N-15/14 (o/oo)	Lab ID Number	Reist ID Number
HORSESHOE BEND	C.NASUS	1719.0	46.8	F	Musc.	30/09/84	-3.13	NA	NA	3002.0	0016682
HORSESHOE BEND	C.NASUS	2150.0	51.2	F	Musc.	31/08/84	-14.23	-23.62	8.68	3012.0	0016637
HORSESHOE BEND	C.NASUS	1533.0	ND	M	Musc.	31/10/84	-0.81	-25.94	7.47	3123.0	0016124
HORSESHOE BEND	C.NASUS	1840.0	ND	F	Musc.	31/10/84	-7.67	NA	NA	3121.0	0016165
HORSESHOE BEND	C.NASUS	1962.0	ND	M	Musc.	30/09/84	1.38	-25.54	6.20	3004.0	0016673
HORSESHOE BEND	C.NASUS	1893.0	ND	F	Musc.	31/10/84	-1.85	NA	NA	3120.0	0016167
HORSESHOE BEND	C.NASUS	1191.0	43.6	M	Musc.	31/08/84	-0.28	-25.73	7.59	3148.0	0016107
HORSESHOE BEND	C.NASUS	2060.0	48.0	F	Musc.	31/10/84	-1.95	-25.43	7.50	3122.0	0016129
HORSESHOE BEND	C.NASUS	1671.0	47.4	F	Musc.	31/08/84	-13.79	NA	NA	3011.0	0016638
HORSESHOE BEND	C.NASUS	2981.0	55.7	F	Musc.	31/08/84	-1.23	-27.55	5.97	3014.0	0016635
HORSESHOE BEND	C.NASUS	1715.0	ND	F	Musc.	30/09/84	-12.08	NA	NA	3003.0	0016680
HORSESHOE BEND	C.NASUS	2137.0	52.4	M	Musc.	31/08/84	-7.18	-23.20	8.90	3152.0	0016102
HORSESHOE BEND	C.NASUS	1589.0	ND	M	Musc.	30/09/84	-4.82	-30.53	7.52	3007.0	0016670
HORSESHOE BEND	C.NASUS	1576.0	45.6	M	Musc.	30/09/84	-15.24	-27.39	9.44	3005.0	0016672
HORSESHOE BEND	C.NASUS	1706.0	50.5	M	Musc.	31/08/84	-0.86	NA	NA	3009.0	0016641
HORSESHOE BEND	C.NASUS	1745.0	49.2	F	Musc.	31/08/84	-10.90	-24.80	7.58	3150.0	0016104
KOBUK R.	C.NASUS	931.0	42.5	F	Musc.	31/10/84	8.40	-29.63	9.11	3053.0	0016413
KOBUK R.	C.NASUS	1252.0	44.5	M	Musc.	31/10/84	10.29	-30.88	11.98	3055.0	0016411
KOBUK R.	C.NASUS	1197.0	44.0	F	Musc.	31/10/84	4.10	-27.44	8.40	3052.0	0016414
KOBUK R.	C.NASUS	628.0	38.0	F	Musc.	31/10/84	3.60	-28.68	10.52	3051.0	0016415
KOBUK R.	C.NASUS	940.0	42.9	M	Musc.	31/10/84	5.96	-26.70	8.75	3054.0	0016412
KOBUK R.	C.NASUS	789.0	41.2	M	Musc.	31/10/84	5.38	-28.83	10.31	3050.0	0016416
KUK CRK DS	C.CLUPE	579.0	36.3	M	Musc.	10/07/85	11.97	-21.46	13.39	3473.0	0018903
KUK CRK DS	C.CLUPE	605.0	36.8	F	Musc.	10/07/85	9.72	-22.63	11.93	3472.0	0018902
KUK CRK DS	C.CLUPE	713.0	38.5	M	Musc.	10/07/85	-6.49	-24.27	12.13	3475.0	0018908
KUK CRK DS	C.CLUPE	587.0	36.7	F	Musc.	10/07/85	12.52	-20.87	13.35	3474.0	0018904
KUK CRK DS	C.CLUPE	312.0	29.1	M	Musc.	10/07/85	8.09	-24.22	12.54	3470.0	0018900
KUK CRK DS	C.CLUPE	363.0	30.7	M	Musc.	10/07/85	7.92	-23.01	12.32	3471.0	0018901
KUK CRK DS	C.NASUS	1017.0	41.6	M	Musc.	10/07/85	-1.78	-25.07	10.29	3462.0	0018754
KUK CRK DS	C.NASUS	1402.0	43.6	F	Musc.	10/07/85	-12.73	-22.41	10.39	3459.0	0018751
KUK CRK DS	C.NASUS	1205.0	43.5	F	Musc.	10/07/85	-17.70	-25.54	9.88	3463.0	0018762
KUK CRK DS	C.NASUS	1515.0	44.5	F	Musc.	10/07/85	-16.15	-23.97	8.40	3460.0	0018752
KUK CRK DS	C.NASUS	1605.0	46.3	M	Musc.	10/07/85	-13.48	-23.65	9.31	3461.0	0018753
KUK CRK DS	C.NASUS	981.0	41.3	M	Musc.	10/07/85	1.17	-21.52	9.70	3458.0	0018750
KUK CRK US	C.CLUPE	512.0	33.9	M	Musc.	10/07/85	9.83	-20.27	13.89	3476.0	0017152
KUK CRK US	C.NASUS	373.0	31.0	M	Musc.	10/07/85	-16.14	-23.67	9.07	3464.0	0018832
KUK CRK US	C.NASUS	291.0	29.8	M	Musc.	10/07/85	-14.96	-23.83	10.14	3466.0	0018834
KUK CRK US	C.NASUS	304.0	29.5	M	Musc.	10/07/85	-4.81	-23.27	9.49	3465.0	0018833
KUK CRK US	C.NASUS	1128.0	45.1	F	Musc.	10/07/85	-14.47	-23.24	7.65	3467.0	0017142
KUK CRK US	C.NASUS	322.0	30.5	M	Musc.	10/07/85	-13.68	-21.89	9.38	3469.0	0018836
KUK CRK US	C.NASUS	355.0	31.3	M	Musc.	10/07/85	-16.25	-24.18	10.83	3468.0	0018835
LAKE 18	C.NASUS	961.0	41.4	M	Musc.	25/07/85	-4.68	-24.63	9.97	3452.0	0018732
LAKE 18	C.NASUS	883.0	42.4	M	Musc.	25/07/85	-9.00	-22.17	7.76	3453.0	0018733
LAKE 18	C.NASUS	912.0	38.7	M	Musc.	25/07/85	-16.52	-23.79	9.02	3454.0	0018734
LAKE 18	C.NASUS	1041.0	40.3	F	Musc.	25/07/85	-6.87	-23.52	7.76	3455.0	0018736
LAKE 18	C.NASUS	1625.0	48.1	F	Musc.	25/07/85	-16.31	-24.49	6.71	3456.0	0018738

Table 3. Cont'd.

Location	Species	Weight (grams)	Length (cm)	Sex	Tissue	Date dd/mm/yy	S-34/32 (o/oo)	C-13/12 (o/oo)	N-15/14 (o/oo)	Lab ID Number	Reist ID Number
LAKE 18	C.NASUS	1777.0	47.0	F	Musc.	25/07/85	2.18	-19.74	10.67	3457.0	0018745
LAKE 18	N.PIKE	1180.0	47.0	F	Musc.	25/07/85	-14.07	-24.52	13.13	3525.0	0017817
LAKE 18	N.PIKE	830.0	47.4	F	Musc.	25/07/85	-14.12	-23.58	13.17	3526.0	0017818
LAKE 18	N.PIKE	805.0	47.0	M	Musc.	25/07/85	-11.12	-23.50	12.51	3527.0	0017819
LAKE 18	N.PIKE	905.0	48.9	M	Musc.	25/07/85	-12.43	-23.68	12.73	3529.0	0017821
LAKE 18	N.PIKE	766.0	45.4	M	Musc.	25/07/85	-13.23	-23.66	12.04	3530.0	0017822
LAKE 18	N.PIKE	762.0	47.0	M	Musc.	25/07/85	-13.53	-23.35	12.43	3528.0	0017820
MCKENZIE R. E	C.CLUPE	1041.0	42.0	F	Musc.	30/09/84	-1.50	-25.63	7.42	3027.0	0016498
MCKENZIE R. E	C.CLUPE	1156.0	44.0	M	Musc.	30/09/84	-1.06	NA	NA	3022.0	0016503
MCKENZIE R. E	C.CLUPE	1237.0	43.0	M	Musc.	30/09/84	-1.03	-27.17	7.52	3026.0	0016499
MCKENZIE R. E	C.CLUPE	1139.0	44.4	F	Musc.	30/09/84	-0.71	NA	NA	3023.0	0016502
MCKENZIE R. E	C.CLUPE	1072.0	43.0	F	Musc.	30/09/84	0.03	NA	NA	3024.0	0016501
MCKENZIE R. E	C.CLUPE	1132.0	44.5	M	Musc.	30/09/84	-0.58	-26.28	8.91	3025.0	0016500
MCKENZIE R. E	C.NASUS	1229.0	44.5	F	Musc.	30/09/84	-14.01	-22.67	7.74	3034.0	0016420
MCKENZIE R. E	C.NASUS	1650.0	48.1	M	Musc.	30/09/84	-0.02	NA	NA	3029.0	0016446
MCKENZIE R. E	C.NASUS	1739.0	47.5	F	Musc.	30/09/84	0.27	-24.43	5.92	3033.0	0016421
MCKENZIE R. E	C.NASUS	1505.0	46.2	M	Musc.	30/09/84	-1.68	-27.12	5.79	3030.0	0016427
MCKENZIE R. E	C.NASUS	1649.0	50.5	M	Musc.	30/09/84	-4.66	-28.34	11.45	3031.0	0016425
MCKENZIE R. E	C.NASUS	1891.0	50.4	F	Musc.	30/09/84	-1.20	-25.67	6.68	3032.0	0016422
MCKENZIE R. U	C.NASUS	1845.0	54.0	F	Musc.	31/10/85	-8.88	NA	NA	3129.0	0016160
MCKENZIE R. U	C.NASUS	1579.0	49.9	M	Musc.	31/10/84	-5.27	NA	NA	3128.0	0016161
MCKENZIE R. U	C.NASUS	1622.0	47.6	M	Musc.	31/10/84	0.56	NA	NA	3127.0	0016162
MCKENZIE R. U	C.NASUS	1726.0	50.2	F	Musc.	31/10/84	-5.01	-25.52	7.15	3130.0	0016159
MCKENZIE R. U	C.NASUS	2050.0	51.8	M	Musc.	31/10/84	1.05	-25.49	6.41	3131.0	0016158
MCKENZIE R. U	C.NASUS	1240.0	46.7	F	Musc.	31/10/84	-14.44	-26.16	9.24	3132.0	0016157
NAUYUK R. D	A.CHARR	ND	69.4	U	Musc.	30/11/76	17.67	NA	NA	3236.0	
NAUYUK R. D	A.CHARR	ND	17.5	U	Musc.	30/11/76	3.23	NA	NA	3215.0	
NAUYUK R. D	A.CHARR	ND	20.5	U	Musc.	30/11/76	-9.68	NA	NA	3185.0	
NAUYUK R. D	A.CHARR	ND	18.3	U	Musc.	30/11/76	-10.04	NA	NA	3205.0	
NAUYUK R. D	A.CHARR	ND	40.0	U	Musc.	30/11/76	12.74	NA	NA	3227.0	
NAUYUK R. D	A.CHARR	ND	ND	U	Musc.	30/11/76	17.63	NA	NA	3238.0	
NAUYUK R. D	A.CHARR	ND	20.7	U	Musc.	30/11/76	3.44	NA	NA	3186.0	
NAUYUK R. D	A.CHARR	ND	40.3	U	Musc.	30/11/76	15.94	NA	NA	3226.0	
NAUYUK R. D	A.CHARR	ND	69.0	U	Musc.	30/11/76	17.47	NA	NA	3237.0	
NAUYUK R. D	A.CHARR	ND	18.3	U	Musc.	30/11/76	-10.61	NA	NA	3214.0	
NAUYUK R. D	A.CHARR	ND	40.9	U	Musc.	30/11/76	17.57	NA	NA	3228.0	
NAUYUK R. D	A.CHARR	ND	17.5	U	Musc.	30/11/76	4.43	NA	NA	3206.0	
NAUYUK R. U	A.CHARR	ND	70.2	U	Musc.	30/11/76	18.18	NA	NA	3234.0	
NAUYUK R. U	A.CHARR	ND	69.7	U	Musc.	30/11/76	17.87	NA	NA	3233.0	
NAUYUK R. U	A.CHARR	ND	39.5	U	Musc.	30/11/76	16.27	NA	NA	3223.0	
NAUYUK R. U	A.CHARR	ND	41.5	U	Musc.	30/11/76	13.85	NA	NA	3225.0	
NAUYUK R. U	A.CHARR	ND	20.6	U	Musc.	30/11/76	15.21	NA	NA	3183.0	
NAUYUK R. U	A.CHARR	ND	68.7	U	Musc.	30/11/76	17.76	NA	NA	3235.0	
NAUYUK R. U	A.CHARR	ND	21.4	U	Musc.	30/11/76	9.05	NA	NA	3184.0	
NAUYUK R. U	A.CHARR	ND	39.9	U	Musc.	30/11/76	16.67	NA	NA	3224.0	
PEEL R.	C.NASUS	1848.0	ND	M	Musc.	30/09/84	-15.01	-30.20	8.47	3144.0	0016132

Table 3. Cont'd.

Location	Species	Weight (grams)	Length (cm)	Sex	Tissue	Date dd/mm/yy	S-34/32 (o/oo)	C-13/12 (o/oo)	N-15/14 (o/oo)	Lab ID Number	Reist ID Number
PEEL R.	C.NASUS	1948.0	ND	F	Musc.	30/09/84	-0.91	-26.46	6.28	3143.0	0016133
PEEL R.	C.NASUS	1957.0	ND	F	Musc.	30/09/84	-13.56	-34.67	8.61	3142.0	0016134
PEEL R.	C.NASUS	2080.0	ND	F	Musc.	30/09/84	-8.93	-30.55	7.60	3146.0	0016130
PEEL R.	C.NASUS	1700.0	ND	M	Musc.	30/09/84	-15.08	-31.07	9.65	3145.0	0016131
PEEL R.	C.NASUS	2002.0	ND	M	Musc.	30/09/84	-15.65	-28.62	8.43	3141.0	0016135
SKIDOO LAKE	C.CLUPE	518.0	39.0	M	Musc.	20/07/85	-0.96	-25.16	7.30	3441.0	0017536
SKIDOO LAKE	C.CLUPE	1050.0	40.4	F	Musc.	20/07/85	-10.58	-24.33	8.27	3443.0	0017539
SKIDOO LAKE	C.CLUPE	1448.0	43.5	M	Musc.	20/07/85	1.53	-26.96	7.18	3442.0	0017537
SKIDOO LAKE	C.CLUPE	1274.0	42.1	F	Musc.	20/07/85	1.95	-25.36	8.95	3444.0	0017542
SKIDOO LAKE	C.CLUPE	1338.0	41.1	F	Musc.	20/07/85	-0.12	-25.72	7.23	3445.0	0017543
SKIDOO LAKE	C.NASUS	2559.0	50.8	M	Musc.	20/07/85	-0.29	-25.51	7.39	3439.0	0017551
SKIDOO LAKE	C.NASUS	2407.0	49.8	M	Musc.	20/07/85	-2.15	-26.65	6.79	3438.0	0017550
SKIDOO LAKE	INCONNU	1428.0	54.2	M	Musc.	20/07/85	1.24	-27.79	10.61	3412.0	0017563
SKIDOO LAKE	INCONNU	1326.0	50.7	M	Musc.	20/07/85	2.97	-26.57	11.30	3411.0	0017562
SOUTH LAKE	C.CLUPE	1249.0	41.1	M	Musc.	29/07/85	NA	-26.88	7.32	3437.0	0017520
SOUTH LAKE	C.CLUPE	1199.0	40.5	M	Musc.	29/07/85	-0.91	-26.09	7.59	3435.0	0017518
SOUTH LAKE	C.CLUPE	1212.0	42.7	F	Musc.	29/07/85	-0.03	-26.08	7.55	3432.0	0017515
SOUTH LAKE	C.CLUPE	1338.0	42.7	M	Musc.	29/07/85	-1.62	-25.36	8.58	3436.0	0017519
SOUTH LAKE	C.CLUPE	1045.0	39.8	F	Musc.	29/07/85	-1.09	-27.29	7.31	3434.0	0017517
SOUTH LAKE	C.CLUPE	2045.0	49.3	F	Musc.	29/07/85	0.85	-15.03	6.64	3433.0	0017516
SOUTH LAKE	C.NASUS	986.0	39.9	M	Musc.	29/07/85	1.04	-26.58	6.45	3426.0	0017529
SOUTH LAKE	C.NASUS	1660.0	47.2	F	Musc.	29/07/85	-1.51	-26.85	7.34	3431.0	0017575
SOUTH LAKE	C.NASUS	1159.0	41.4	M	Musc.	29/07/85	-3.56	-26.34	7.91	3427.0	0017570
SOUTH LAKE	C.NASUS	2006.0	46.4	F	Musc.	29/07/85	1.74	-25.13	6.10	3429.0	0017573
SOUTH LAKE	C.NASUS	2399.0	48.2	F	Musc.	29/07/85	2.14	-25.80	6.51	3428.0	0017572
SOUTH LAKE	C.NASUS	1398.0	42.3	M	Musc.	25/07/85	-16.10	-25.13	8.87	3430.0	0017574
STARVATION	A.CHARR	ND	ND	U	Musc.	30/11/76	12.24	NA	NA	3154.0	
STARVATION	A.CHARR	ND	ND	U	Musc.	30/11/76	12.20	NA	NA	3156.0	
STARVATION	A.CHARR	ND	ND	U	Musc.	30/11/76	12.49	NA	NA	3158.0	
STARVATION	A.CHARR	ND	ND	U	Musc.	30/11/76	12.70	NA	NA	3161.0	
STARVATION	A.CHARR	ND	ND	U	Musc.	30/11/76	12.51	NA	NA	3160.0	
STARVATION	A.CHARR	ND	ND	U	Musc.	30/11/76	12.65	NA	NA	3159.0	
STARVATION	A.CHARR	ND	ND	U	Musc.	30/11/76	12.46	NA	NA	3157.0	
STARVATION	A.CHARR	ND	ND	U	Musc.	30/11/76	12.42	NA	NA	3155.0	
TRAVAILLANT LAKE	C.CLUPE	398.0	ND	M	Musc.	03/08/85	-9.84	-26.41	10.47	3449.0	0018004
TRAVAILLANT LAKE	C.CLUPE	368.0	ND		Musc.	03/08/85	-9.01	-25.66	11.16	3295.0	0018005
TRAVAILLANT LAKE	C.CLUPE	2305.0	52.7	M	Musc.	03/08/85	-8.43	-24.27	10.22	3292.0	0018018
TRAVAILLANT LAKE	C.CLUPE	1895.0	47.7	F	Musc.	03/08/85	-9.69	-25.47	10.13	3293.1	0018002
TRAVAILLANT LAKE	C.CLUPE	1571.0	47.8	F	Musc.	03/08/85	-8.95	-23.51	8.37	3451.0	0018013
TRAVAILLANT LAKE	C.CLUPE	531.0	33.8	M	Musc.	03/08/85	-9.74	-24.32	9.59	3448.0	0018003
TRAVAILLANT LAKE	C.CLUPE	1905.0	51.4	F	Musc.	03/08/85	-9.40	-26.54	10.34	3446.0	0018001
TRAVAILLANT LAKE	C.CLUPE	1153.0	42.9	F	Musc.	03/08/85	-9.18	-24.97	10.37	3296.0	0018025
TRAVAILLANT LAKE	C.CLUPE	1130.0	41.6	M	Musc.	03/08/85	-9.61	-28.31	10.30	3297.0	0018026
TRAVAILLANT LAKE	C.CLUPE	429.0	31.3	M	Musc.	03/08/85	-10.14	-26.46	11.77	3294.0	0018014
TRAVAILLANT LAKE	C.NASUS	1482.0	47.5	M	Musc.	07/11/84	-11.11	-25.16	9.75	3110.0	0016238
TRAVAILLANT LAKE	C.NASUS	1438.0	44.1	M	Musc.	03/08/85	-11.59	-25.14	10.93	3605.0	0018049

Table 3. Cont'd.

Location	Species	Weight (grams)	Length (cm)	Sex	Tissue	Date dd/mm/yy	S-34/32 (o/oo)	C-13/12 (o/oo)	N-15/14 (o/oo)	Lab ID Number	Reist ID Number
TRAVAILLANT LAKE	C.NASUS	1352.0	44.3	F	Musc.	07/1 /84	-11.26	-24.93	10.26	3106.0	0016282
TRAVAILLANT LAKE	C.NASUS	1188.0	42.0	M	Musc.	26/0 /86	-14.43	-26.55	7.32	3612.0	0022109
TRAVAILLANT LAKE	C.NASUS	1574.0	44.0	F	Musc.	26/09/86	-12.58	-26.14	10.55	3613.0	0022111
TRAVAILLANT LAKE	C.NASUS	1635.0	50.5	M	Musc.	07/11/84	-11.17	NA	NA	3107.0	0016241
TRAVAILLANT LAKE	C.NASUS	1578.0	45.8	F	Musc.	26/09/86	-11.05	NA	NA	3615.0	0022115
TRAVAILLANT LAKE	C.NASUS	1438.0	44.5	F	Musc.	03/08/85	-11.48	-24.82	9.95	3609.0	0018054
TRAVAILLANT LAKE	C.NASUS	1449.0	47.0	F	Musc.	03/08/85	-11.65	-25.86	10.23	3604.0	0018048
TRAVAILLANT LAKE	C.NASUS	1427.0	ND	M	Musc.	07/11/84	-11.59	NA	NA	3108.0	0016240
TRAVAILLANT LAKE	C.NASUS	1493.0	45.0	M	Musc.	26/09/86	-10.87	-24.65	8.63	3610.0	0022107
TRAVAILLANT LAKE	C.NASUS	1257.0	45.2	F	Musc.	07/11/84	-11.48	-26.14	9.80	3111.0	0016237
TRAVAILLANT LAKE	C.NASUS	1581.0	47.3	M	Musc.	26/09/86	-10.69	-26.27	8.81	3611.0	0022108
TRAVAILLANT LAKE	C.NASUS	2073.0	51.4	M	Musc.	03/08/85	-10.71	-26.02	9.34	3606.0	0018050
TRAVAILLANT LAKE	C.NASUS	1802.0	51.3	F	Musc.	03/08/85	-15.83	-25.10	9.08	3608.0	0018052
TRAVAILLANT LAKE	C.NASUS	1451.0	45.8	M	Musc.	03/08/85	-12.96	-26.94	8.13	3607.0	0018051
TRAVAILLANT LAKE	C.NASUS	1488.0	ND	F	Musc.	07/11/84	-12.05	-25.75	10.68	3109.0	0016239
TRAVAILLANT LAKE	C.NASUS	1845.0	49.5	F	Musc.	26/09/86	-14.59	-27.91	10.09	3614.0	0022114
TRAVAILLANT LAKE	C.W.SUCKER	ND	ND	U	Musc.	03/08/85	-8.64	-25.63	NA	3312.0	0018073
TRAVAILLANT LAKE	C.W.SUCKER	ND	ND	U	Musc.	03/08/85	-9.11	-23.36	7.48	3313.0	0018136
TRAVAILLANT LAKE	C.W.SUCKER	ND	ND	U	Musc.	03/08/85	-8.35	-24.04	8.04	3314.0	0018074
TRAVAILLANT LAKE	C.W.SUCKER	ND	ND	U	Musc.	03/08/85	-8.25	-25.69	8.19	3310.0	0018075
TRAVAILLANT LAKE	C.W.SUCKER	ND	ND	U	Musc.	03/08/85	-8.53	-24.26	8.47	3311.0	0018072
TRAVAILLANT LAKE	L.CISCO	125.0	23.7	F	Musc.	03/08/85	-9.41	-25.90	10.07	3315.0	0018100
TRAVAILLANT LAKE	L.CISCO	156.0	24.9	F	Musc.	03/08/85	-8.76	-25.79	11.17	3316.0	0018109
TRAVAILLANT LAKE	L.CISCO	71.0	19.6	M	Musc.	03/08/85	-9.71	-25.42	10.26	3320.0	0018098
TRAVAILLANT LAKE	L.CISCO	128.0	22.7	F	Musc.	03/08/85	-8.82	-25.56	10.88	3317.0	0018104
TRAVAILLANT LAKE	L.CISCO	113.0	22.5	F	Musc.	03/08/85	-9.14	-25.94	9.96	3318.0	0018101
TRAVAILLANT LAKE	L.CISCO	127.0	22.3	F	Musc.	03/08/85	-8.96	-27.71	11.18	3319.0	0018108
TRAVAILLANT LAKE	L.TROUT	2028.0	ND	U	Musc.	03/08/85	-8.43	-29.20	14.22	3303.0	0018085
TRAVAILLANT LAKE	L.TROUT	7818.0	ND	U	Musc.	03/08/85	-8.32	-26.26	13.93	3299.0	0018077
TRAVAILLANT LAKE	L.TROUT	2396.0	ND	U	Musc.	03/08/85	-8.42	-24.97	13.18	3301.0	0018079
TRAVAILLANT LAKE	L.TROUT	2369.0	ND	U	Musc.	03/08/85	-8.55	-26.81	13.21	3302.0	0018082
TRAVAILLANT LAKE	L.TROUT	5244.0	ND	U	Musc.	03/08/85	-9.48	-26.72	14.32	3298.0	0018078
TRAVAILLANT LAKE	L.TROUT	2841.0	ND	U	Musc.	03/08/85	-8.87	-30.51	14.37	3300.0	0018084
TRAVAILLANT LAKE	N.PIKE	1111.0	ND	U	Musc.	03/08/85	-9.05	-24.84	11.35	3307.0	0018063
TRAVAILLANT LAKE	N.PIKE	1332.0	ND	U	Musc.	03/08/85	-9.20	-24.92	NA	3309.0	0018058
TRAVAILLANT LAKE	N.PIKE	1259.0	ND	U	Musc.	03/08/85	-9.46	-24.90	11.39	3305.0	0018059
TRAVAILLANT LAKE	N.PIKE	1299.0	ND	U	Musc.	03/08/85	-10.22	-24.55	12.97	3304.0	0018061
TRAVAILLANT LAKE	N.PIKE	661.0	ND	U	Musc.	03/08/85	-8.67	-26.09	10.36	3308.0	0018066
TRAVAILLANT LAKE	N.PIKE	1100.0	ND	U	Musc.	03/08/85	-8.67	-24.68	10.63	3306.0	0018058
TRAVAILLANT LAKE	N.S.BACK	0.7	ND	U	Whole	03/08/85	-8.76	-24.97	NA	3321.0	
TRAVAILLANT LAKE	N.S.BACK	0.8	4.5	U	Musc.	03/08/85	NA	-25.84	9.21	3322.0	
TRAVAILLANT LAKE	N.S.BACK	0.8	4.5	U	Musc.	03/08/85	NA	-25.21	8.71	3323.0	
TRAVAILLANT LAKE	YOY PIKE	1.9	6.7	U	Musc.	03/08/85	NA	-26.22	8.81	3326.0	
TRAVAILLANT LAKE	YOY PIKE	2.8	8.6	U	Musc.	03/08/85	NA	-26.53	8.62	3327.0	
TRAVAILLANT LAKE	YOY PIKE	1.9	ND	U	Whole	03/08/85	-9.31	-26.52	8.70	3325.0	
WILLOW CREEK D	A.CHARR	ND	60.5	U	Musc.	30/11/76	16.30	NA	NA	3182.0	

Table 3. Cont'd.

Location	Species	Weight (grams)	Length (cm)	Sex	Tissue	Date dd/mm/yy	S-34/32 (o/oo)	C-13/12 (o/oo)	N-15/14 (o/oo)	Lab ID Number	Reist ID Number
WILLOW CREEK D	A.CHARR	ND	17.3	U	Musc.	30/11/76	10.87	NA	NA	3219.0	
WILLOW CREEK D	A.CHARR	ND	59.0	U	Musc.	30/11/76	16.77	NA	NA	3181.0	
WILLOW CREEK D	A.CHARR	ND	18.0	U	Musc.	30/11/76	11.31	NA	NA	3218.0	
WILLOW CREEK D	A.CHARR	ND	17.8	U	Musc.	30/11/76	10.07	NA	NA	3217.0	
WILLOW CREEK D	A.CHARR	ND	18.7	U	Musc.	30/11/76	11.17	NA	NA	3216.0	
WILLOW CREEK U	A.CHARR	ND	60.5	U	Musc.	30/11/76	17.53	NA	NA	3179.0	
WILLOW CREEK U	A.CHARR	ND	60.3	U	Musc.	30/11/76	17.84	NA	NA	3180.0	
YUKON R.	C.CLUPE	1628.0	47.0	F	Musc.	10/09/84	-0.84	-33.13	9.84	3047.0	0016418
YUKON R.	C.CLUPE	1447.0	43.9	F	Musc.	10/09/84	1.40	-33.95	6.62	3048.0	0016417
YUKON R.	C.NASUS	2730.0	36.5	F	Musc.	10/09/84	-0.16	-30.33	7.17	3045.0	0016444
YUKON R.	C.NASUS	2231.0	50.9	M	Musc.	10/09/84	0.52	-27.54	8.55	3044.0	0016445
YUKON R.	C.NASUS	1907.0	48.9	F	Musc.	10/09/84	3.63	-25.10	8.43	3046.0	0016419
YUKON R.	C.NASUS	2209.0	52.6	M	Musc.	10/09/84	1.25	-31.04	7.46	3043.0	0016467